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ABSTRACT

Developed by the Westinghouse Electric Corporation, Video Audio Compressed (VIDAC) is a compressed time, variable rate, still picture television system. This technology made it possible for a centralized library of audiovisual materials to be transmitted over a television channel in very short periods of time. In order to establish specifications for equipment design, existing commercial audiovisual programing was evaluated to determine the length and the number of picture changes in a typical commercial program. Characteristics of 4,000 titles from 27 companies were surveyed and coded to grade level and subject area. Statistical tables and graphs show the distribution of surveyed programs by subject and grade level. Graphs and additional material relate the characteristics of the surveyed commercial filmstrips to the VIDAC technology. (Author/DS)

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AUDIO/VISUAL RATIOS IN COMMERCIAL FILMSTRIPS

Nancy L. Gulliford

December 1974

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Foreword

Westinghouse Electric Corporation has under development a compressed time, variable rate, still picture television system known as VIDAC. The technology makes possible a centralized library of audiovisual material which can be transmitted over a television channel in very short periods of time. In order to establish specifications for equipment design, existing commercial audiovisual programming was evaluated to determine the length and the number of picture changes in typical commercial programs.

Pages 1 through 22 describe the characteristics of a large sample of commercial sound filmstrips. Pages 23 through 28 relate these characteristics to the VIDAC technology.

VISUAL/AUDIO RATIOS IN COMMERCIAL FILMSTRIPS

(Sample Drawn from 1974 Catalogues of Producers)

I. Introduction

Much of the literature about preparation of audiovisual materials is replete with rules about how many visuals are required to make a "good" set of materials, but there appears to have been little systematic attempt to find out what practicing commercial producers actually do. Sound filmstrips were chosen for study, because by definition they contain both audio and visual material and because by definition they are paced by the audio rate contained therein.

II. Methods of Collection

The NICEM (National Information Center for Educational Media) directory of 35mm filmstrips lists 52,000 total sound and silent filmstrips. Of the companies who say they prepare some educational materials, about 25 appear to turn out more than 10 sound filmstrips per year. These companies were contacted by telephone for information. Companies often have more than one production manager or subcontracting house which actually decide what will constitute a sound filmstrip. Though the information which I requested may be available, it is not always given out. Instead, a telephone survey yields averages and rules of thumb.

Since a telephone survey did not appear to be the best method for obtaining the desired information, a request for copies of the current catalog was substituted. At the same time, a search of the Audiovisual

Instruction magazine section called "Media Review Digest Supplement" from December, 1974, to May, 1974, yielded a half year's sample.

Some of the largest houses, such as Walt Disney Productions and Eye Gate did not list both number of frames and minutes of audio. Others, such as Society for Visual Instruction, did. Thus, this survey represents material produced by those producers who listed both pieces of information.

The sample is made up of nearly 4,000 individual titles, which were coded as to grade level and subject area and gathered into groupings which were intended to be large enough to provide meaningful averages as data. Career Education, Grades 1-6, and Vocational Education, Grades 7-8, were too small to yield good grouped averages and were not plotted separately.

The sample ranges from programs about a minute and a half long to about 45 minutes. But the average program consists of 54 frames of visual material and is about 12 minutes long.

Represented in Survey - 27 Companies

Audio Visual Narrative Arts
*Coronet Films
Current Affairs Films
Doubleday Multimedia
Educational Activities
Educational Audio Visual
Educational Dimensions Corporation
EMC Corporation
*Encyclopedia Brittanica Corporation
Filmstrip House
Guidance Associates
*Hoffman Occupational Learning Systems
Marsh Film Enterprises
McGraw-Hill
*Miller-Brody
New York Filmstrips on Current Affairs
Q&ED Productions (also produce for other houses)
Scott Education Division
Schloat Productions

*Very large representation in survey

Scholastic Magazines
Spoken Arts
Society for Visual Education (Division of Singer)
Sunburst Communications
Teaching Resources Films
Universal Education and Visual ARts
Viking Press
Visual Publications

III. Discussion of the Data

Material gathered was coded for keypunch and fed to a computer for sorting and printing. The resulting printout produced tables which were used to develop the information desired. Tables 1 and 2 provide a statistical summary of the overall sample.

TABLE 1

Subject Area	Grade Level	No. Programs In Sample	Percent Of Total	Average Program Length-Minutes	Average No. Visuals/ Minute
Language Arts	1-8	443	11.19	9.5	4.89
includes reading)	9-Adult	172	4.34	15.0	4.56
Social Studies-History	1-8	748	18.89	12.0	4.64
	9-Adult	697	17.60	15.0	4.79
Science-Math	1-8	300	7.58	11.5	4.90
	9-Adult	239	6.04	13.5	4.55
Career Education	1-6	17	.43	Small Sample-under 100	5.69
	7-Adult	101	2.55	11.0	5.02
Vocational Education	7-8	20	.51	Small Sample-under 100	3.86
	9-Adult	534	13.48	6.0	4.67
All Other:	1-8	307	7.75	11.0	5.25
	9-Adult	382	9.65	13.0	5.14

Drug Abuse
Sex Education
Music Appreciation
Women's Rights
Teacher Education
Child Care

TABLE 2

Total Programs in Sample	3,960
No. of Visuals in Total Sample	215,443
Total Length of Sample	2845276.8 sec 47421.28 min 790 hr 21 min
Average No. of Visuals/Minute	4.54
Average No. of Visuals/Program	54
Average Program Length (min)	12

	Smallest	Largest
Minutes	1.50	44.50
Visuals/Minute	1.00	14.17

Terms Used

Since the ratio of audio to visual material was a desired output of the data, visual data is usually expressed as Visuals per Minute (vpm) and audio data (program length) is expressed in minutes.

Overall Sample (Figures 1, 2, and 3)

Figure 1 shows the distribution of subjects by grade level in percent. The subjects which represent 50% of the survey are:

1.	Social Studies-History, Grades 1-8	18.89%
2.	Social Studies-History, Grades 9-Adult	17.60%
3.	Vocational Education, Grades 9-Adult	13.48%
		50.00%

Figure 2 demonstrates that the most common program lengths in minutes for all programs surveyed are 10, 12, 15, and 17 minutes, with the average program running 12 minutes in length. Figure 3 shows that the average number of Visuals per Minute (vpm) decreases as programs get longer, ranging from above 6 vpm for programs less than 7 minutes in length, to 5 vpm for 11-minute programs, to 4.5 for programs of 13 to 15 minutes in length, to 4 vpm for 17-minute programs, and about 3.5 vpm for extremely long programs of 24 or more minutes in length.

Language Arts (Figures 4, 5, 6, and 7)

Programs intended for viewing by young children--stories with pictures or grammar lessons--average 9.5 minutes in length, although a significant number range from 5 to 15 minutes (see Figure 4). The characteristic of vpm versus program length is steeper than for most subject areas (Figure 5) ranging from nearly 8 vpm to 3.5 vpm. The average visual rate was 4.5 vpm.

Programs intended for young adults (Figures 6 and 7), on the other hand, averaged 15 minutes in length with visual rates ranging from 5.5 down to 2 vpm (the lowest point of surveyed materials).

Social Studies-History (Figures 8, 9, 10, and 11)

Social Studies and History were grouped because they are treated as one by producers. Material intended for younger children was distributed over a range of program lengths from 10 to 17 minutes with an average of 12 minutes. Video rates decreased from 8 vpm for the shorter programs to 4 vpm for programs in excess of 13 minutes (Figures 8 and 9). Programs intended for viewing by older persons averaged 15 minutes in length--two minutes longer than for the younger children. Variations in visual rates were about the same as those for younger children's programs (Figures 10 & 11).

Social Studies-History is by far the largest representative group in the survey, comprising over 36% of the total sample. This may indicate that this type of program is easier to produce, or it may be a reflection on availability of visuals, or teachers in this area may find such filmstrips of greater value. Perhaps these teachers are more adventurous. It does appear that the producers find this a lucrative area.

Science/Mathematics (Figures 12, 13, 14, and 15)

Figure 12 shows that about 20% of programs in this area intended for primary-intermediate grades are 10 minutes long with an equal percentage at the 12- and 13-minute length. Average length was 11.5 minutes. Though the visual rate exhibited the widest swing in the survey, running from 12.5 to 1 vpm, the large majority of programs run at about 4.9 vpm (Figure 13). Fifteen minutes is a popular length for upper grade and college level

material, followed by 11- and 16-minute programs; 13.5 minutes is average (Figure 14). The behavior in visuals per minute is quite similar to the master curve for total sample, rather flat and running at about 4.5 vpm (Figure 15). A very few short programs are above 7 vpm, but one is 3 vpm; so there is little consistent behavior to observe for programs below 10 minutes in length. For programs longer than 13 minutes the visual rate is constant at 4.5 vpm.

Career Education (Figures 16 and 17)

There were few commercially available sound filmstrips for young children, though we know that many primary age materials are available, more often as shuffle cards, learning activity packets, or actual play situations--"Ths is what the Grocer . . . Postman . . . etc. does." Producers were more inclined to assume that junior high, high school, and out of school age persons had similar interests and understanding levels. Thus, the available material is coded Grade 7 through Adult. In Figure 16 we see that, though long programs were available and 11 minutes is a norm, many programs are planned to run 6 minutes. A dip in visual rate, uncommon to the other subject areas, occurred at the 13- to 14-minute mark, going to 4 vpm and climbing back to about 4.7 vpm.

Vocational Education (Figures 18 and 19)

As with Career Education, surveyed producers apparently find that the ready market is not in elementary or intermediate grades. Almost all of their material, which represented about 14% of the total sampled filmstrips, was coded for Ninth Grade through Adult. It is probable

that beginning "How to . . ." material is the same for any age group from the age of 14 on, so they treat it that way. These programs were unlike all other types represented in the survey (Figure 18).

They are half as long. The majority (50%) were normally distributed from 3 to 7 minutes with a mean for that group of 4.5 minutes. Total range was from 1.5 minutes to 44.5 minutes long. An average program runs 6 minutes. The visual rate runs from 5.7 vpm at the 3-minute mark to 4.4 vpm at 6.5 minutes in length. At 9 minutes it flattens to a little below 4 vpm and remains there out to the 45-minute mark (Figure 19).

All Other Subject Matter (Figures 20, 21, 22, and 23)

All other subject matter was lumped and includes much that is not primarily for cognitive or psychomotor learning. Attitude setting is common to many, and some in-service for teachers is included. Sex education, drug education, music appreciation, holiday topical material, women's rights, equal opportunity, and other materials produced patterns which are most easily classified as "Affective Education."

Material intended for use by younger children portrays a rather flat distribution as exhibited by the histogram (see Figure 20). Of all the programs in the grouping, 70% are 8 to 17 minutes in length, while the average length was 11 minutes. The relationship between visual rate and program length is relatively steep (Figure 21). Material which is less than 8.0 minutes long uses well over 7 vpm. Ten-minute programs use 5 vpm. At 15 minutes the visual rate drops to 4 vpm and continues down into the 2 vpm range. The average visual rate is about 4.6-4.5 vpm.

Material which is intended for older audiences exhibits rather different results (see Figure 22). The distribution is more nearly normal with an average length of 13 minutes. In Figure 23, you can see that a 10-minute program consumes about 6.5 vpm; a 13-minute program, about 5.2 vpm; a 15-minute program, about 5 vpm; dipping to under 4 vpm by 17 minutes and tailing out to about 3.5 vpm beyond 18 minutes.

Affective, Cognitive, and Psychomotor Skills Correlation

"Affective Education" programs tend to use about 5 visuals per minute. Affective education is "values" oriented and is often modeled toward entertainment to convey a point. Drug abuse, sex education, etc. are affectively oriented. Cognitive skills programs (thinking logically) tend to conform to the total sample average of 4.5 visuals/minute. In both cases programs designed for older children and adults tend to be longer in length. In the psychomotor skills area, programs are only half as long as those in affective and cognitive areas. Such programs use about 4.7 visuals/minute. They tend to be single concept and concentrate on one skill at a time.

IV. Summary

A non-random sample of 3960 sound filmstrips from currently available (1974) commercial catalogs was selected. Program length and visual rates of display were recorded and analyzed both as a total sample and as subject matter samples. The total program sample behavior was not indicative of the individual subject sample behaviors; however, a number of general conclusions could be drawn. They include:

1. Shorter programs use proportionately more visuals per minute than longer programs.

2. Material intended for use by older students in the affective and cognitive areas is somewhat longer than that intended for use by younger students (about 2 minutes longer).

3. Vocational material average program length is less than half as long as other "secondary" graded material.

4. Social Studies-History subject matter represented the greatest number of programs, had the longest average program length, and used more visuals per minute than any other subject area.

No attempt to value judge the productions has been made, nor is one intended. The sample selected is relatively large, but it was not a random sample; so care should be exercised in the use of the conclusions.

Productions from non-commercial sources were not addressed. Those with special interests would probably wish to develop their own base line patterns for comparison with these areas.

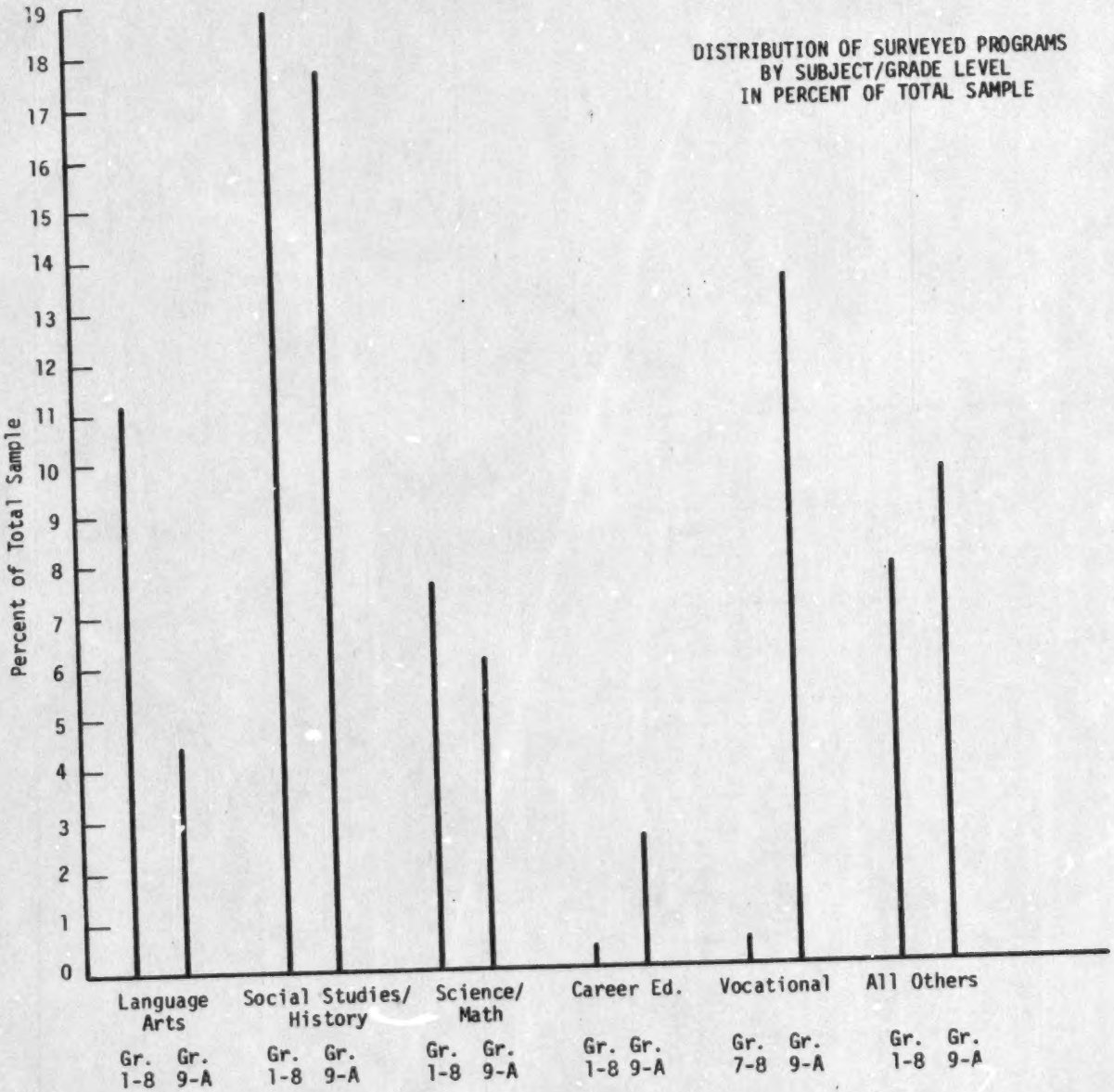
DISTRIBUTION OF SURVEYED PROGRAMS
BY SUBJECT/GRADE LEVEL
IN PERCENT OF TOTAL SAMPLE
Percent of Total Sample
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
Language Arts
Gr. 1-8
Gr. 9-A
Social Studies/ History
Gr. 1-8
Gr. 9-A
Science/ Math
Gr. 1-8
Gr. 9-A
Career Ed.
Gr. 1-8
Gr. 9-A
Vocational
Gr. 7-8
Gr. 9-A
All Others
Gr. 1-8
Gr. 9-A

FIGURE 1

DISTRIBUTION OF 3960 COMMERCIAL FILMSTRIPS

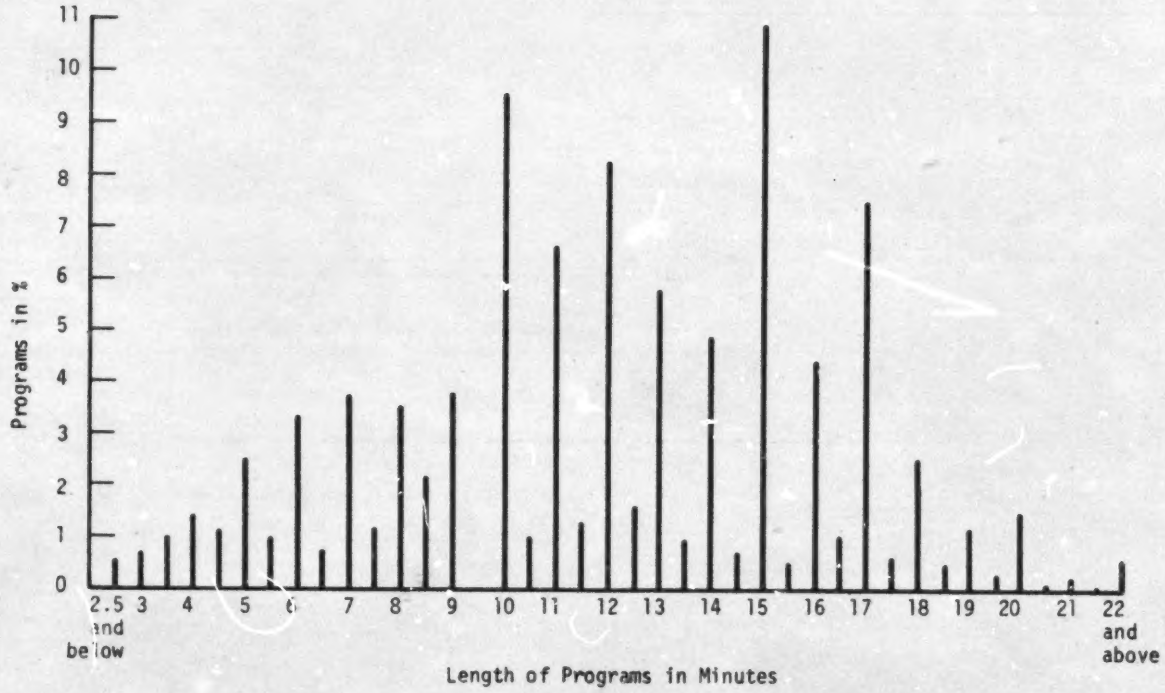

FIGURE 2

DISTRIBUTION OF 3960 COMMERCIAL FILMSTRIPS

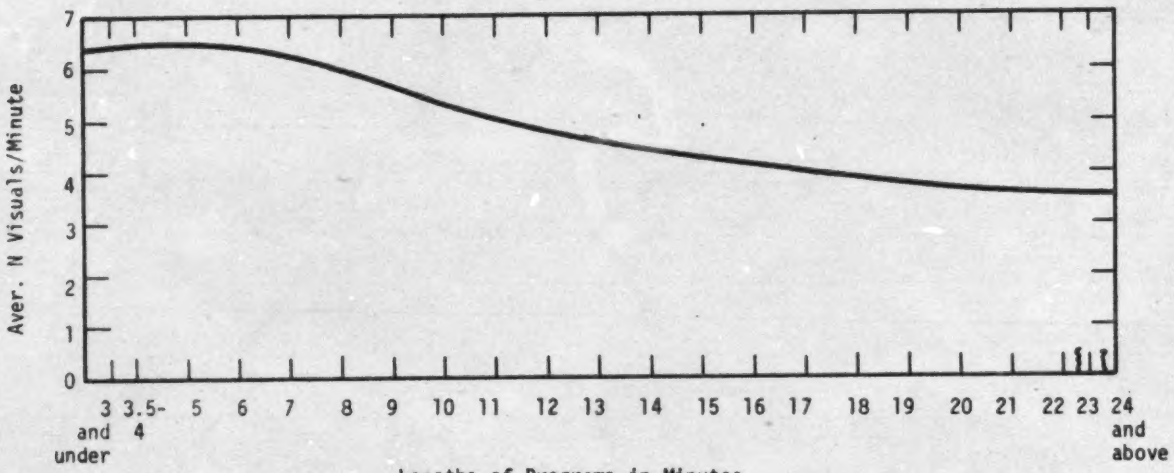

FIGURE 3

DISTRIBUTION OF LANGUAGE ARTS FILMSTRIPS, GR. 1-8 (N=443)

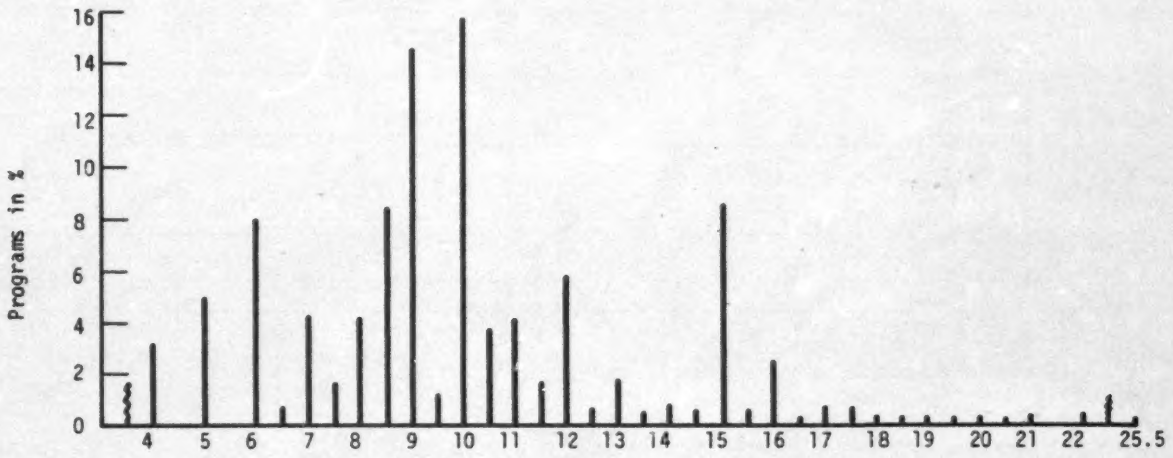

FIGURE 4

DISTRIBUTION OF LANGUAGE ARTS, GR. 1-8 (N=443)

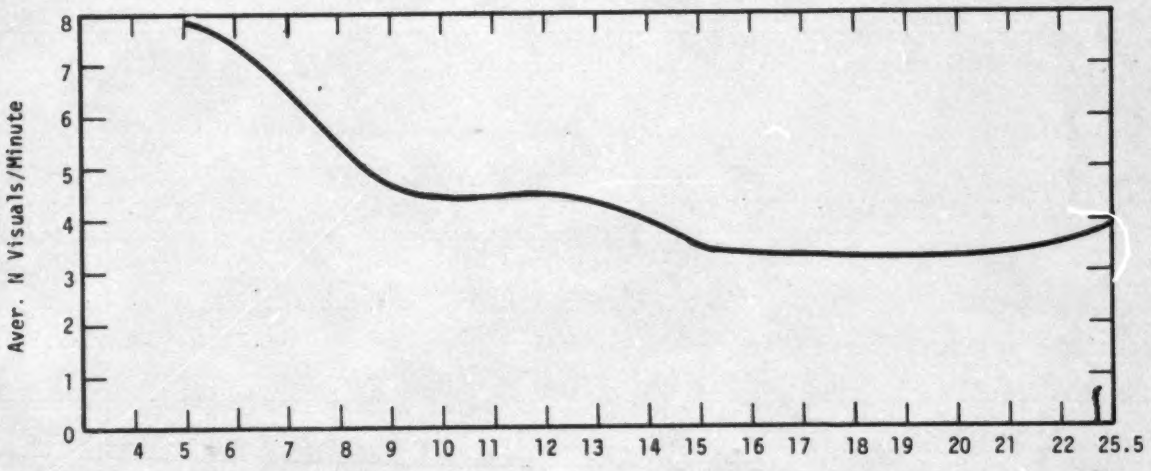

FIGURE 5

DISTRIBUTION OF LANGUAGE ARTS FILMSTRIPS, GR. 9-ADULT (N=172)

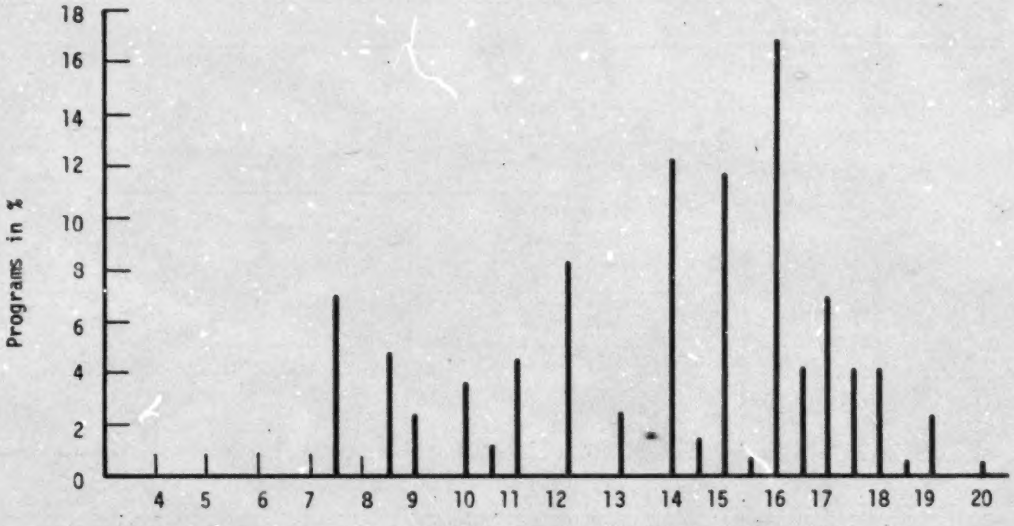

FIGURE 6

DISTRIBUTION OF LANGUAGE ARTS, GR. 9-ADULT (N=172)

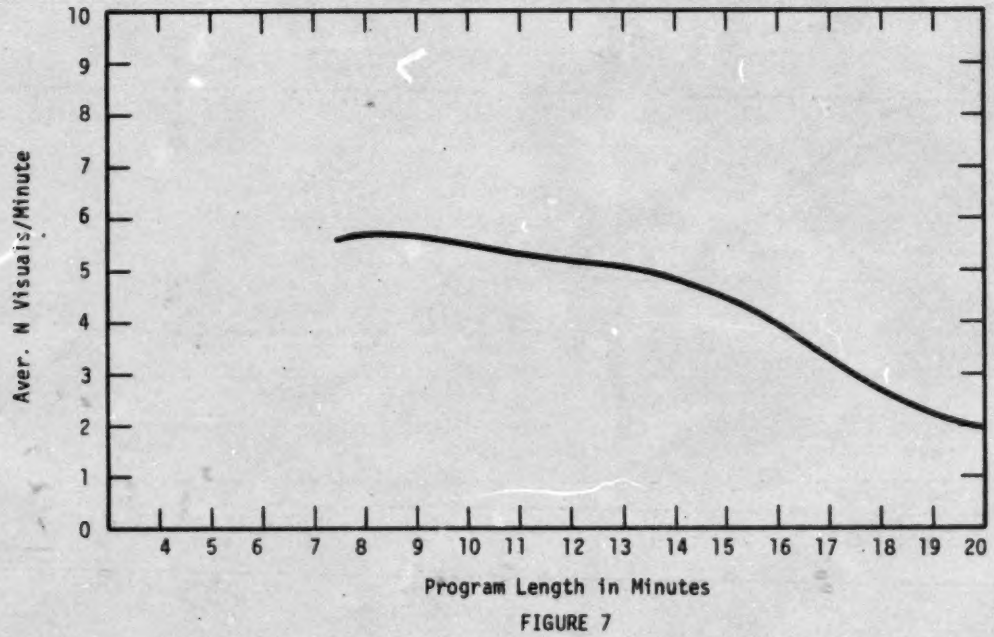

FIGURE 7

DISTRIBUTION OF SOCIAL STUDIES/HISTORY, GR. 1-8 (N=748)

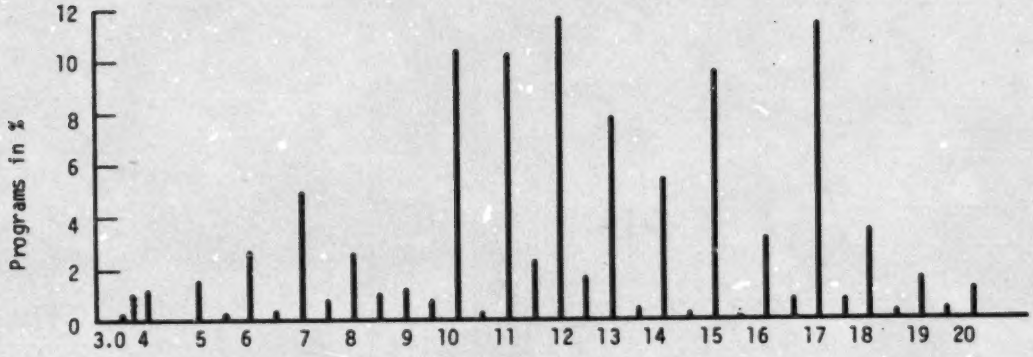

FIGURE 8

DISTRIBUTION OF SOCIAL STUDIES/HISTORY, GR. 1-8 (N=748)

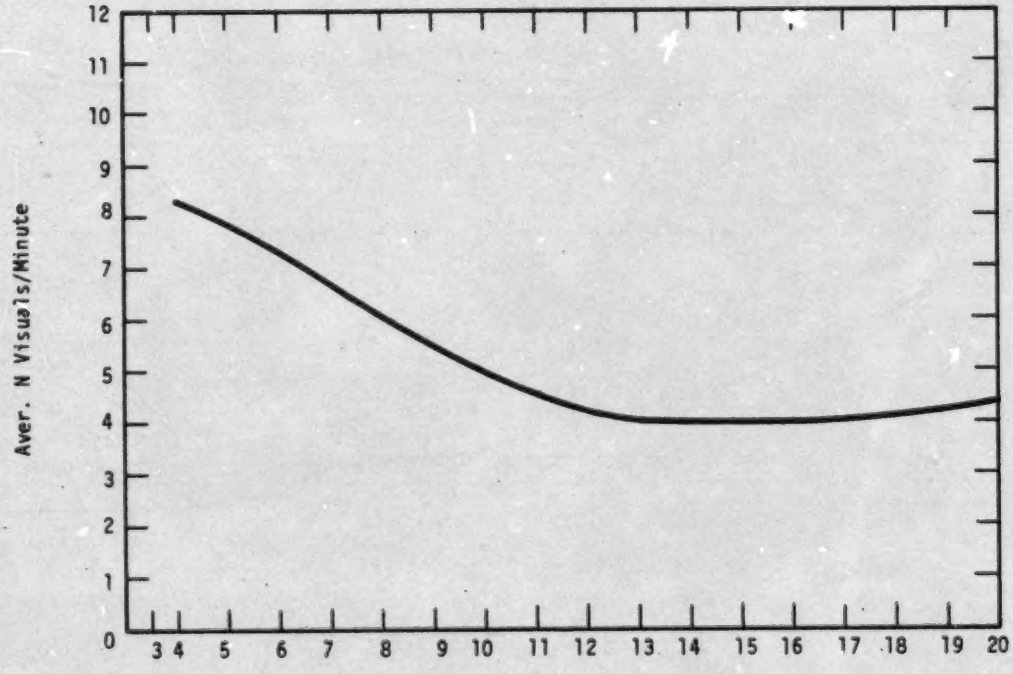

FIGURE 9

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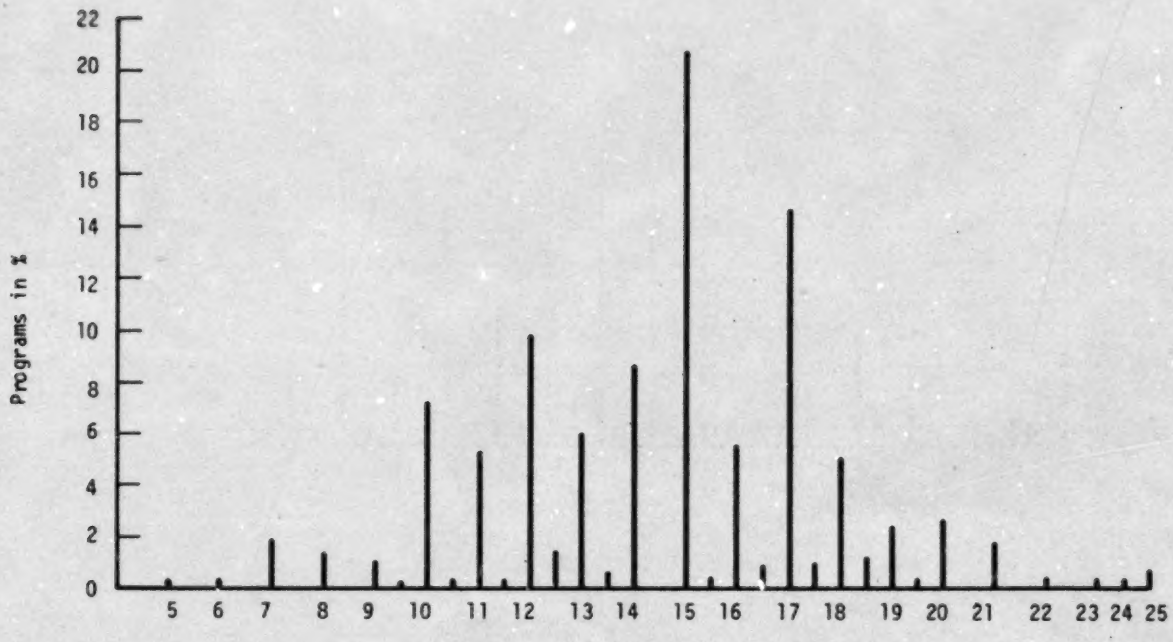

FIGURE 10

DISTRIBUTION OF SOCIAL STUDIES/HISTORY, GR. 9-ADULT (N=697)

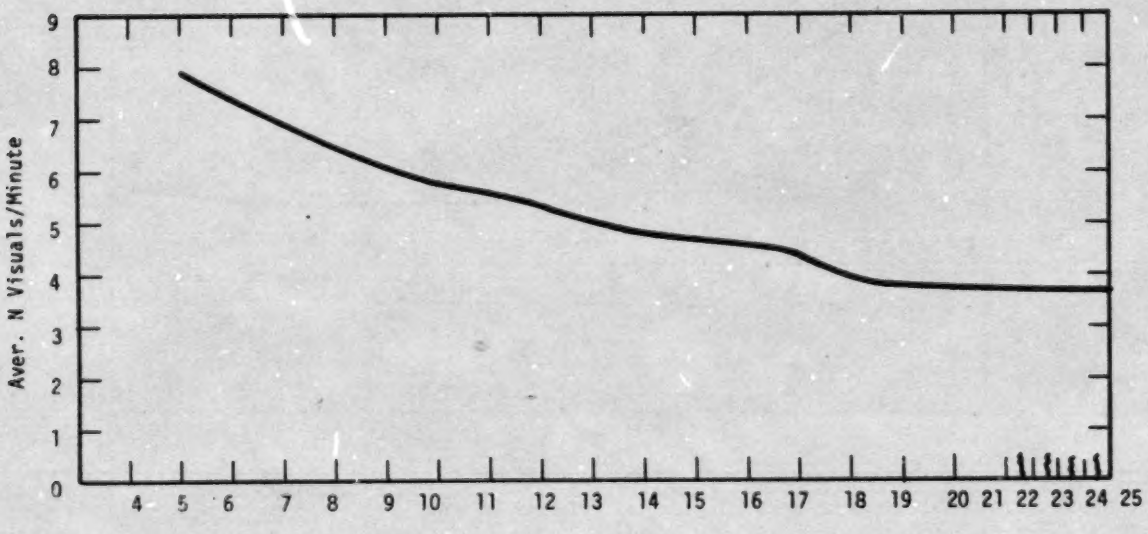

FIGURE 11

DISTRIBUTION OF SCIENCE/MATH, GR. 1-8 (N=300)

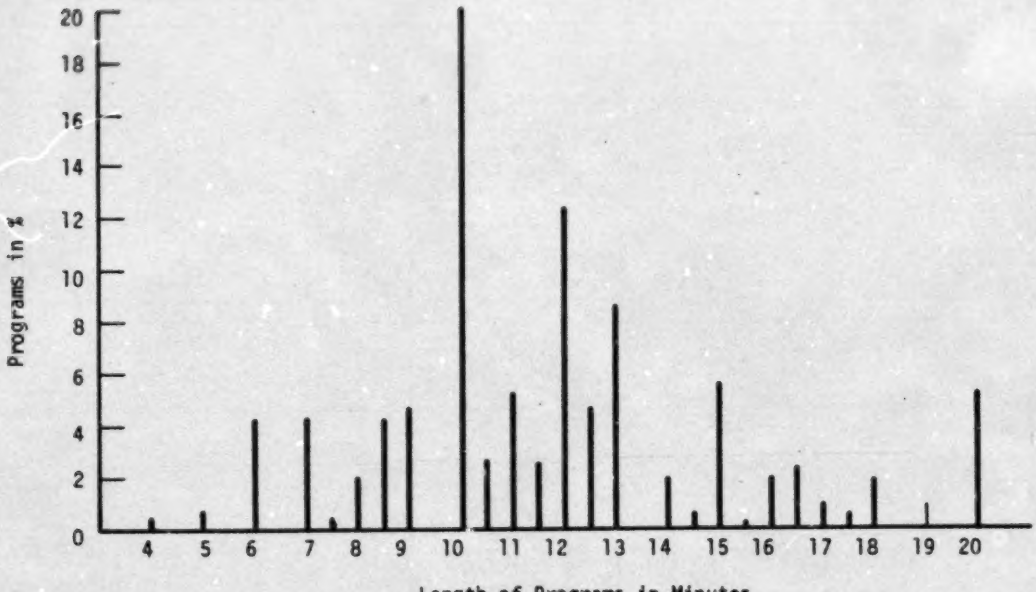

FIGURE 12

DISTRIBUTION OF SCIENCE/MATH, GR. 1-8 (N=300)

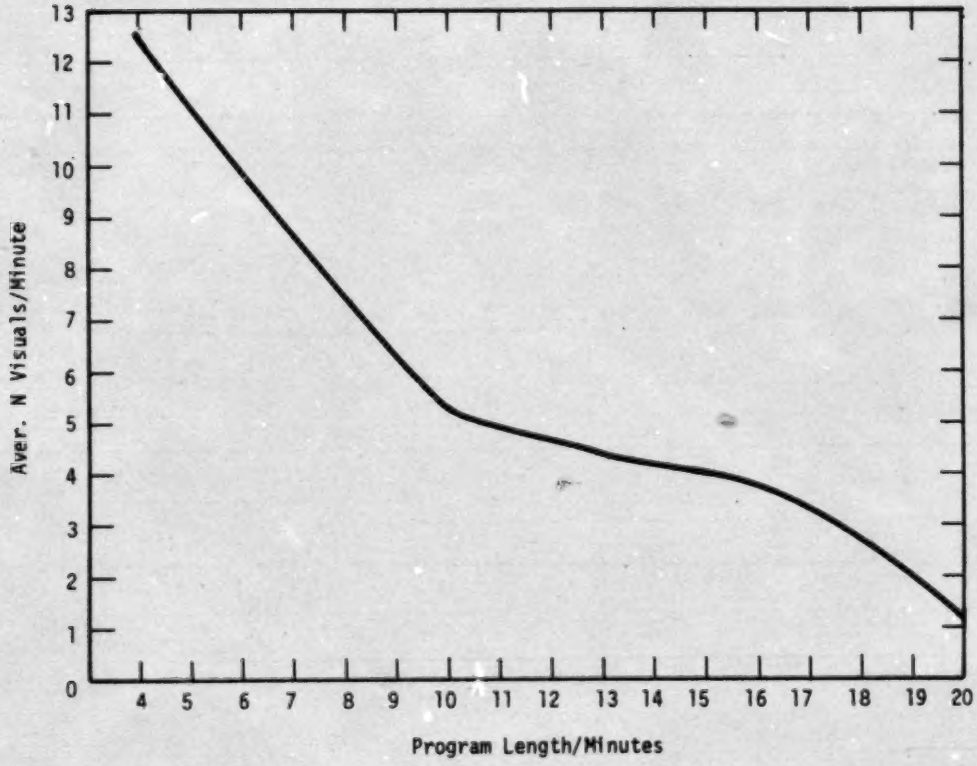

FIGURE 13

DISTRIBUTION OF SCIENCE/MATH, GR. 9-ADULT (N=239)

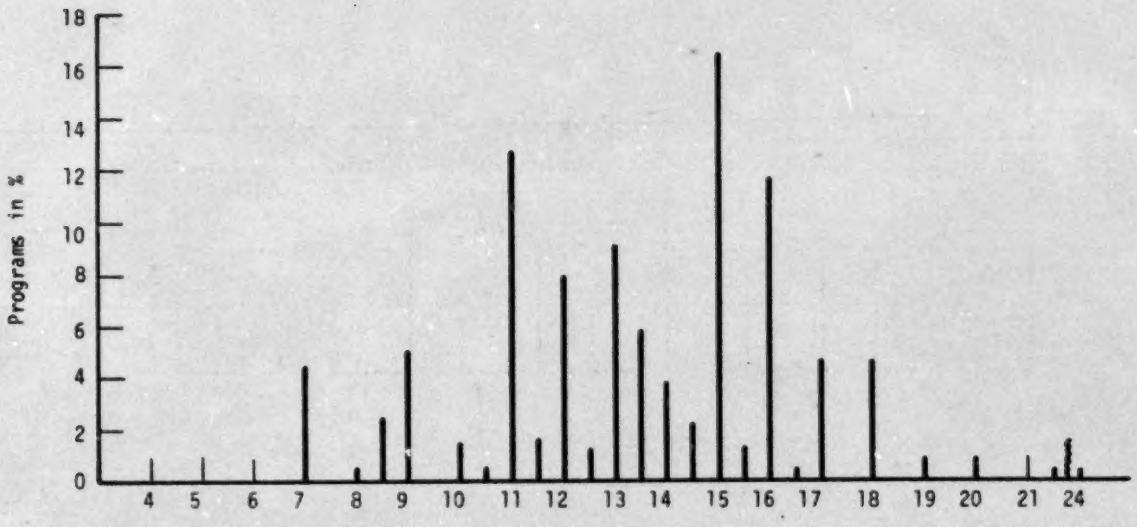

FIGURE 14

DISTRIBUTION OF SCIENCE/MATH, GR. 9-ADULT (N=239)

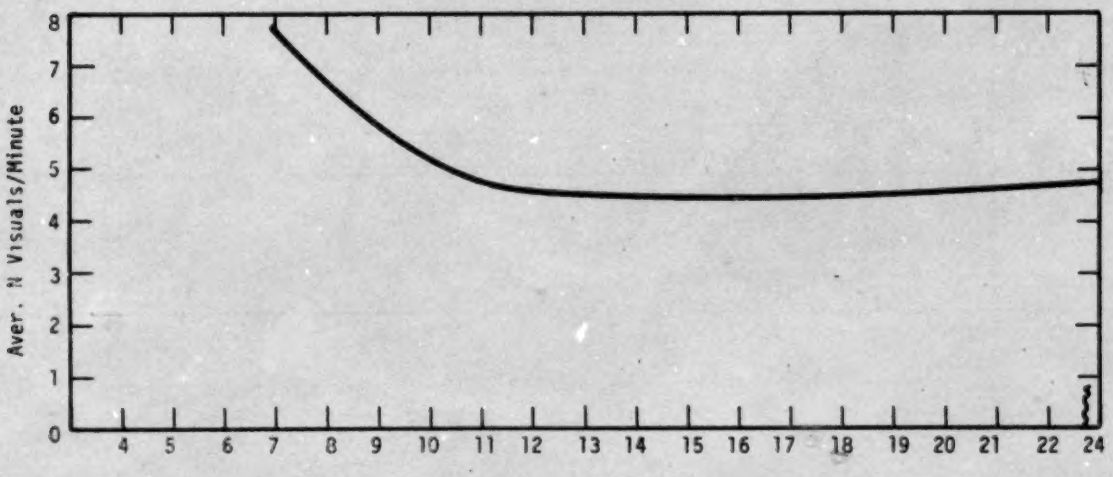

FIGURE 15

DISTRIBUTION OF CAREER EDUCATION FILMSTRIPS, GR. 7-ADULT (N=101)

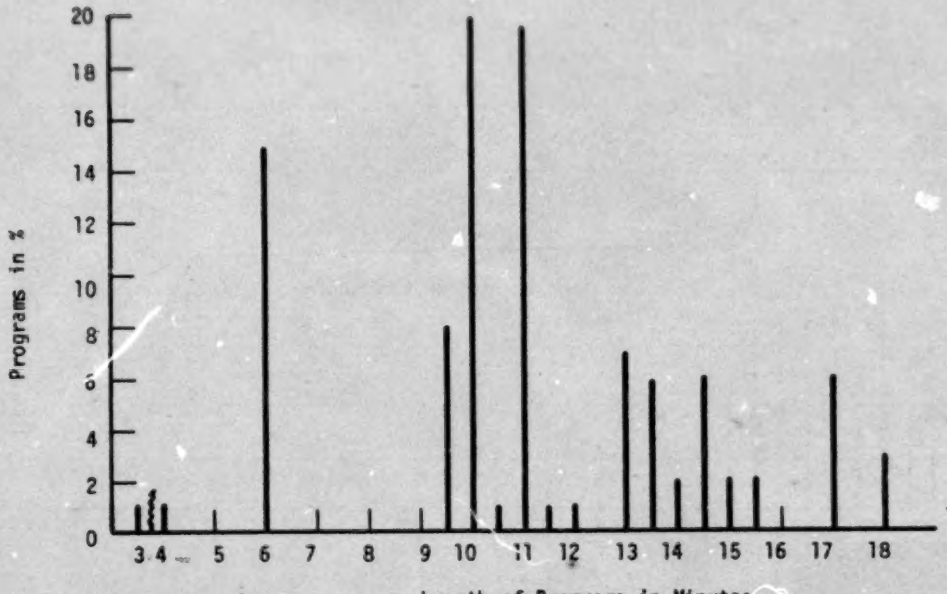

FIGURE 16

DISTRIBUTION OF CAREER EDUCATION, GR. 7-ADULT (N=101)

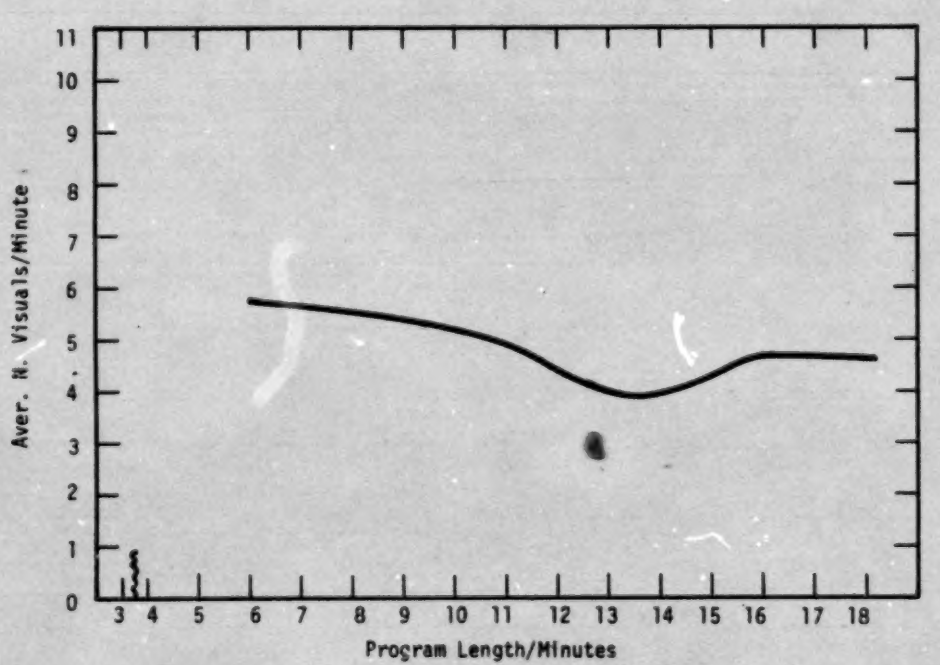

FIGURE 17

DISTRIBUTION OF VOCATIONAL EDUCATION FILMSTRIPS, GR. 9-ADULT (N=534)

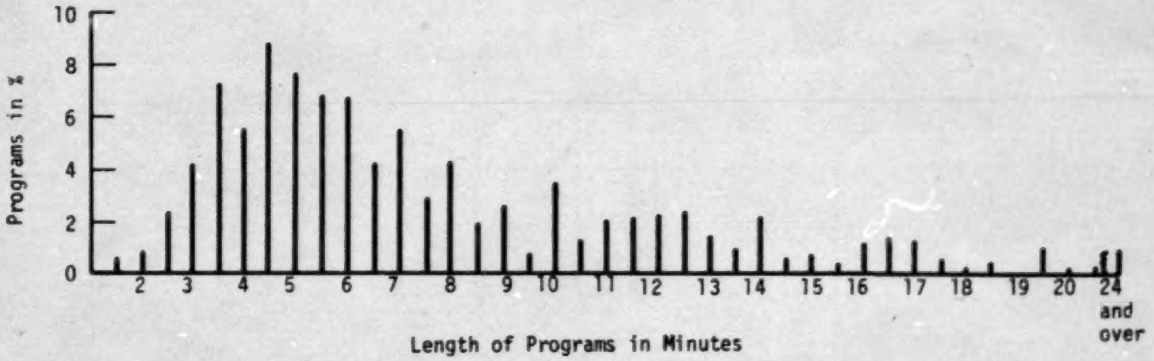

FIGURE 18

DISTRIBUTION OF VOCATIONAL EDUCATION, GR. 9-ADULT (N=534)

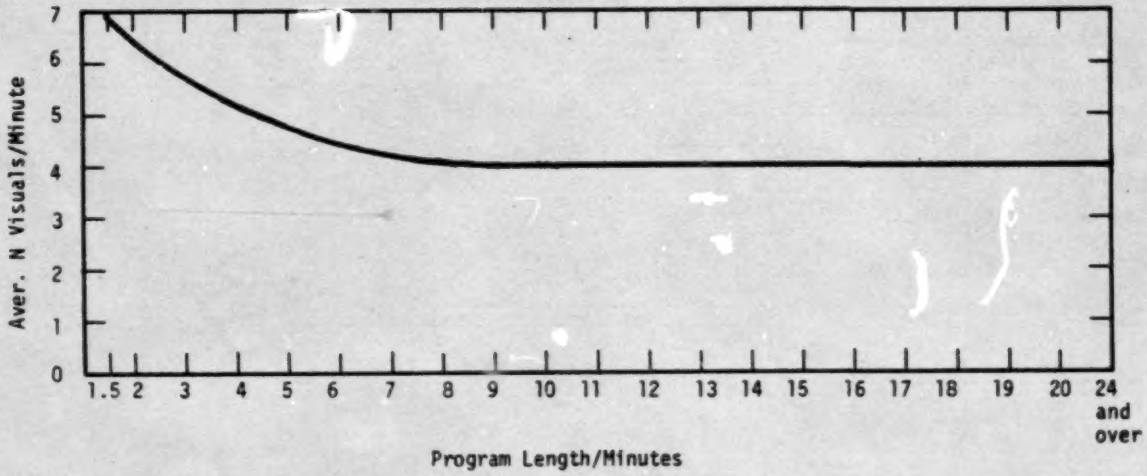

FIGURE 19

DISTRIBUTION OF ALL OTHER SUBJECT MATTER FILMSTRIPS, GR. 1-8 (N=307)

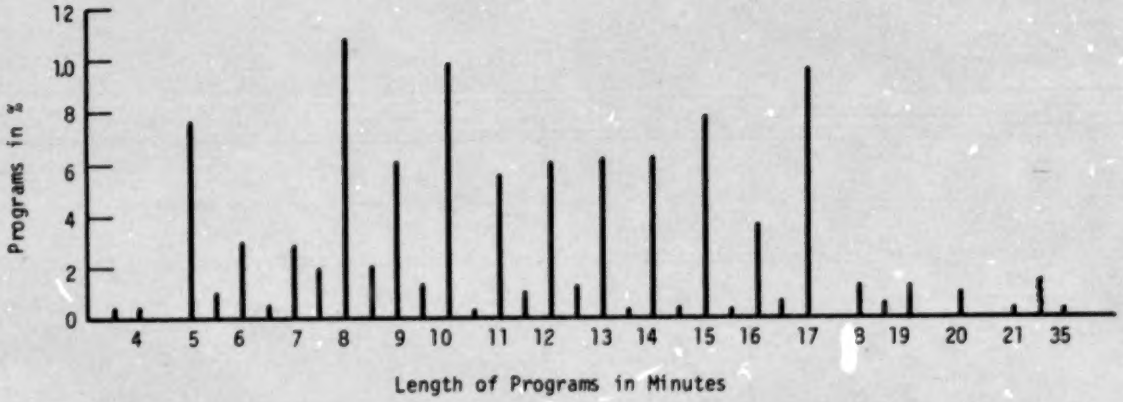

FIGURE 20

DISTRIBUTION OF ALL OTHER SUBJECTS, GR. 1-8 (N=307)

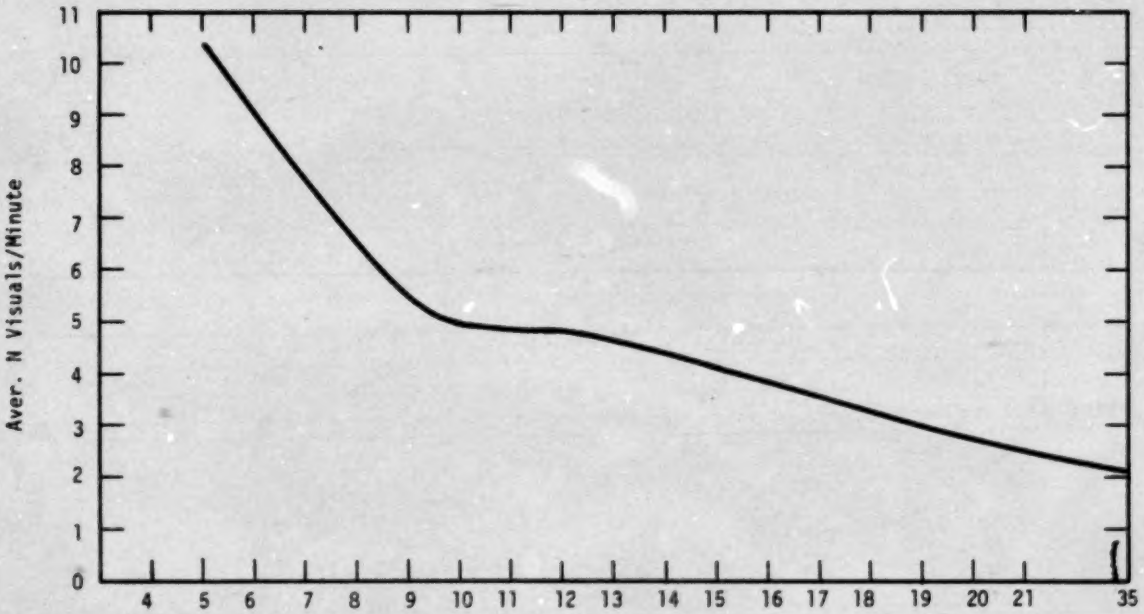

FIGURE 21

DISTRIBUTION OF ALL OTHER SUBJECT MATTER FILMSTRIPS, GR. 9-ADULT (N=382)

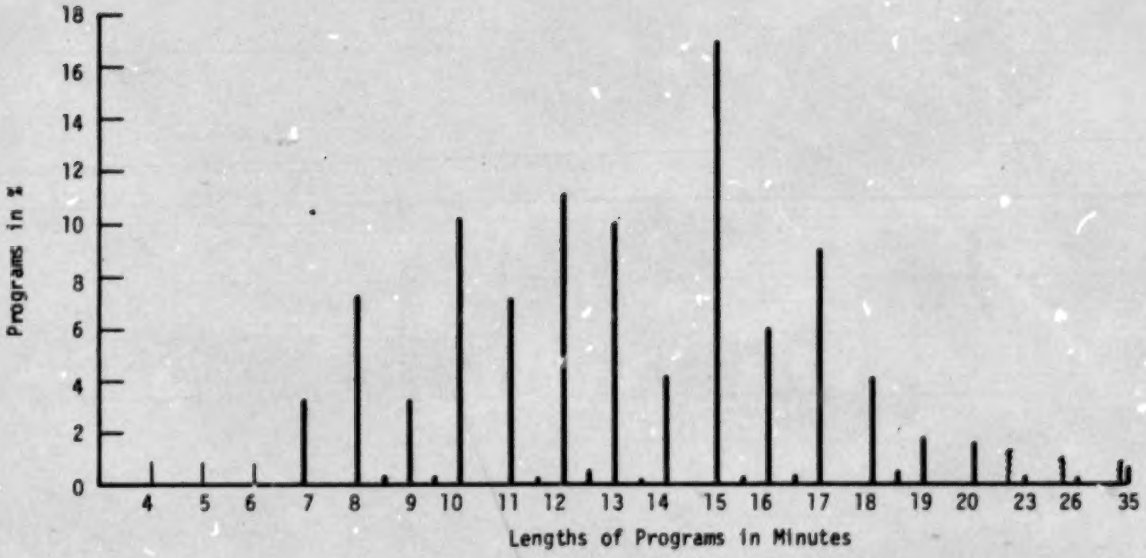

FIGURE 22

DISTRIBUTION OF ALL OTHER SUBJECTS, GR. 9-ADULT (N=382)

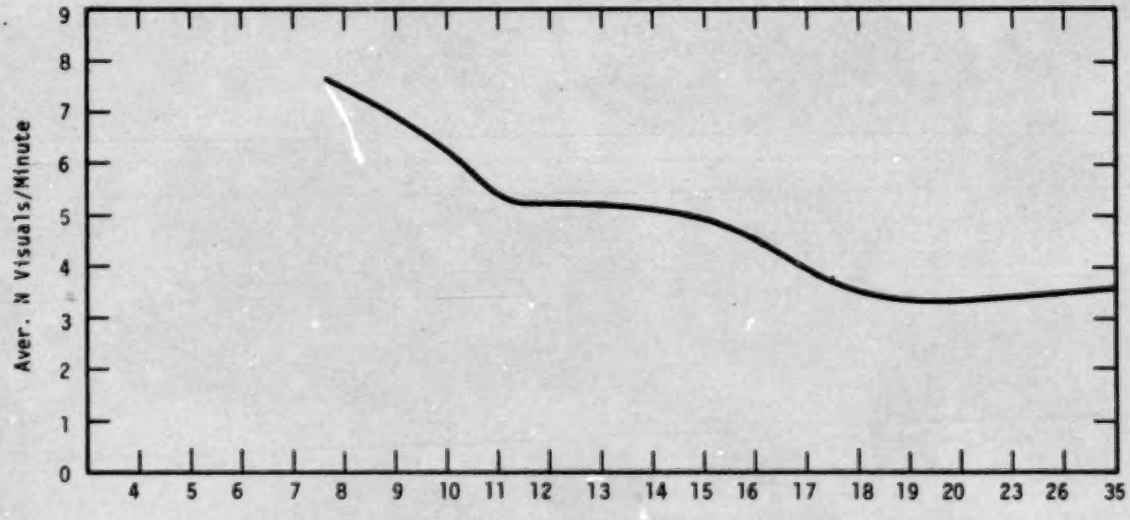

FIGURE 23

VIDAC™ Applicability

VIDAC™ (VIDeo Audio Compression) is a recent technical development by Westinghouse Electric Corporation. It is a color, variable rate, still picture television system which makes possible the distribution of instructional television programming in compressed time over any conventional television channel. Programming is converted into a series of video and audio television frames so that each picture uses a single frame (1/30 of a second) and each 16 seconds of audio is converted into what is called an "audio frame." The program may then be transmitted at 30 frames per second so that a typical 15-minute program using 60 picture changes can be transmitted in 4 seconds.

At the receiving location the program is "acquired" in 4 seconds, stored for later replay, and may then be played back in the original expanded 15-minute period. At the transmitting location the compressed programming may be stored in the compressed form on ordinary video tape. That is, the 15-minute program could be stored on 4 seconds or 60 inches of broadcast video tape running at 15 inches per second.

Table 3 relates the sample programs to a VIDAC compressed time television system by indicating the number of VIDAC frames (video and audio) in an average program for each of the subject areas evaluated. It is indicative of the amount of video tape required to store the average program at the transmitting location as well as the number of frames of storage required at the receiving terminal in order to store one or more programs. Since television channels operate at a 30 frame

per second rate, the total transmission time in seconds for the average program can be obtained by dividing the average number of frames by 30.

Table 4 provides a number of interesting statistics regarding the conversion of the sample programs to VIDAC format. The 3,960 programs represented could be transmitted over a single television channel in 3 hours and 46 minutes. It would take in excess of 6 months of school time for those same programs to be played back without pause in real viewing time. The total library could be stored on four one-hour reels of video tape.

Table 4 indicates that the average compression ratio for the sample programs was 210:1, the average transmission time per program was 3.43 seconds, the average program length was 12 minutes, and the average number of VIDAC frames per program was 100.

Figure 24 indicates that the number of VIDAC frames required per program is approximately normally distributed with a mean of about 100 frames and 80% falling between 60 and 140 frames per program.

Figure 25 provides a means of determining what percent of the sample programs could be stored within a given size receiving terminal storage facility. It indicates that 150 frames would be required to accommodate in excess of 90% of these commercial programs and that 105 frames would be required to accommodate 50% of the programs. The data may also be used to determine the probability of accommodating a given number of programs on a fixed capacity receiving terminal.

TABLE 3

Subject Area	Grade Level	Programs In Sample	Percent Of Total	Average Program Length	Average No. Visuals/ Minute	Average No. VIDAC Frames/ Program
Language Arts (includes reading)	1-8	443	11.19	9.5	4.89	85.16
	9-Adult	172	4.34	15.0	4.56	117.15
Social Studies-History	1-8	748	18.89	12.0	4.64	105.15
	9-Adult	697	17.60	15.0	4.79	126.18
Science-Math	1-8	300	7.58	11.5	4.90	100.47
	9-Adult	239	6.04	13.5	4.55	113.49
Career Education	1-6	17	.43	Small Sample-under 100	5.69	118.29
	7-Adult	101	2.55	11.0	5.02	97.98
Vocational Education	7-8	20	.51	Small Sample-under 100	3.86	113.45
	9-Adult	534	13.48	6.0	4.67	65.02
All Other:	1-8	307	7.75	11.0	5.25	101.25
	9-Adult	382	9.65	13.0	5.14	118.40

Drug Abuse
Sex Education
Music Appreciation
Women's Rights
Teacher Education
Child Care

TABLE 4

Total Programs in Sample	3,960
No. of Visuals in Total Sample	215,443
Total Length of Sample (sec) (min)	2845276.8 47421.28 (790 hrs 21 mins)
VIDAC Transmission Time (sec)	13564.88 (3 hrs 46 mins)
Compression Ratio (Raw)	210:1
Average No. Visuals/Minute	4.54
Average VIDAC Transmission Time (sec/program)	3.43
Average No. of Frames/Program	100
Average No. of Visuals/Program	54
Average Program Length (min)	12

	Smallest	Largest
Minutes	1.50	44.50
Visuals/Minute	1.00	14.17
VIDAC Frames	17	356

DISTRIBUTION OF 3960 COMMERCIAL FILMSTRIPS

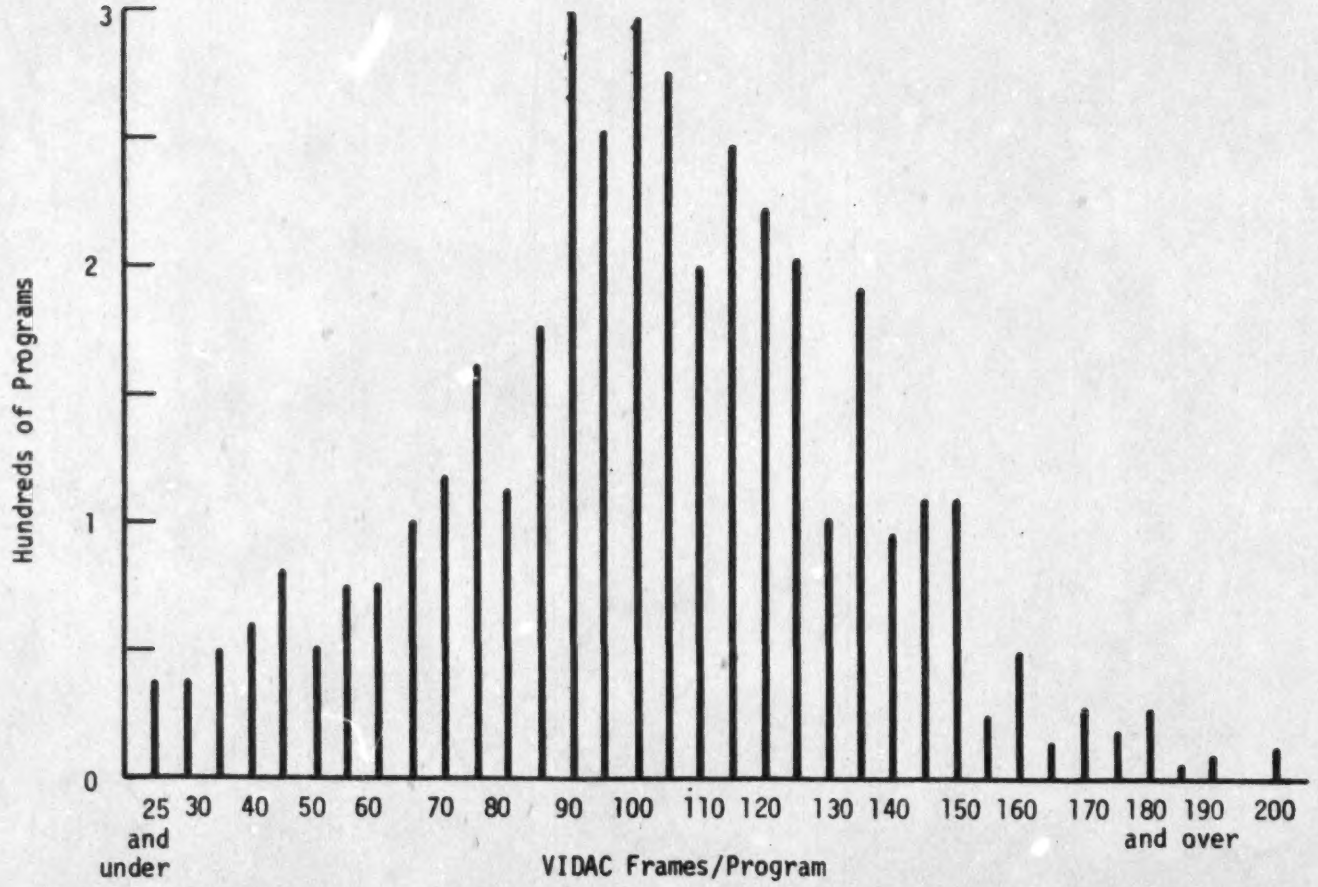

FIGURE 24

DISTRIBUTION OF 3960 COMMERCIAL FILMSTRIPS

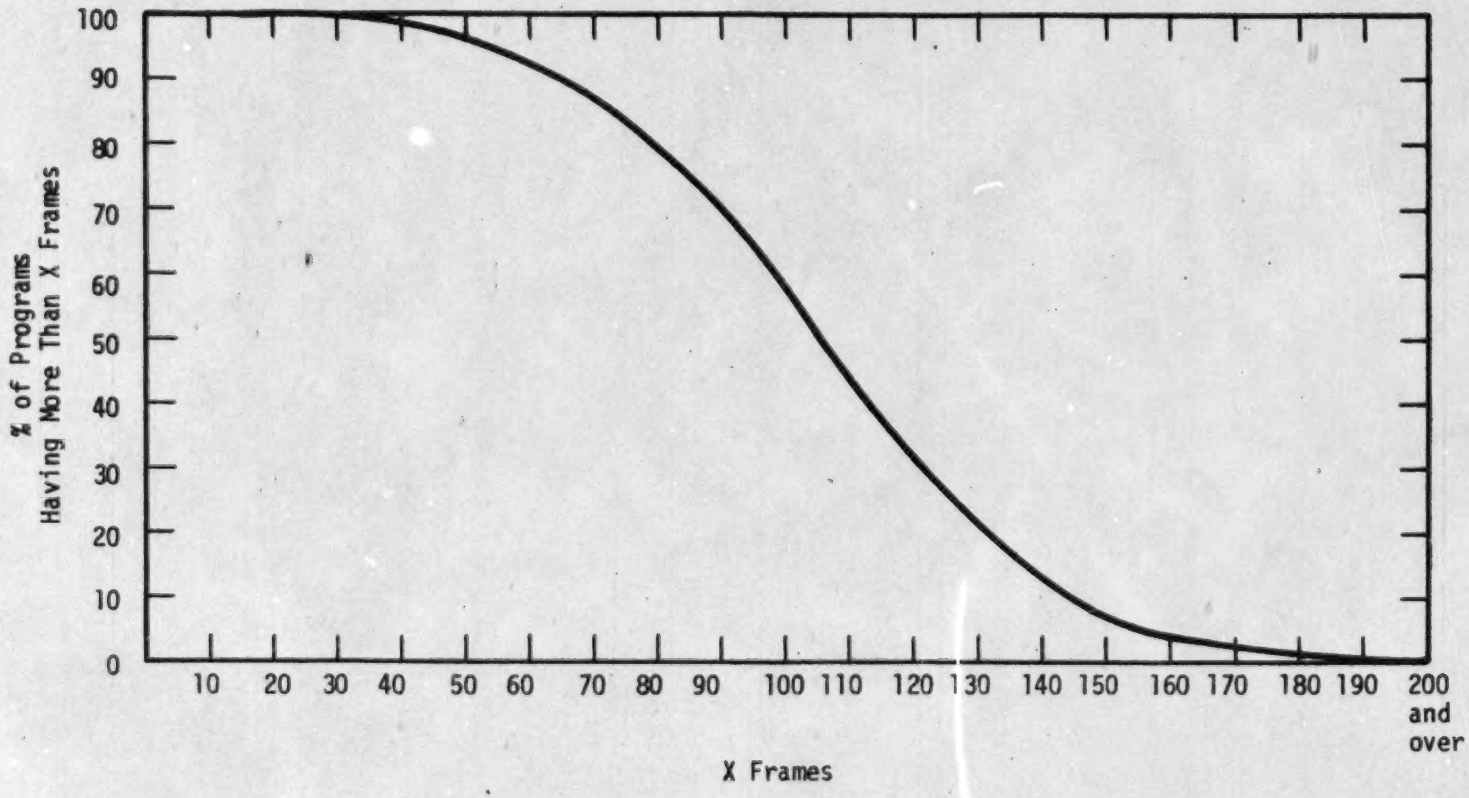

FIGURE 25